Prospect of Energy-saving for CO_2 Emission Control in China

Prof. Kefa Cen

Zhejiang University

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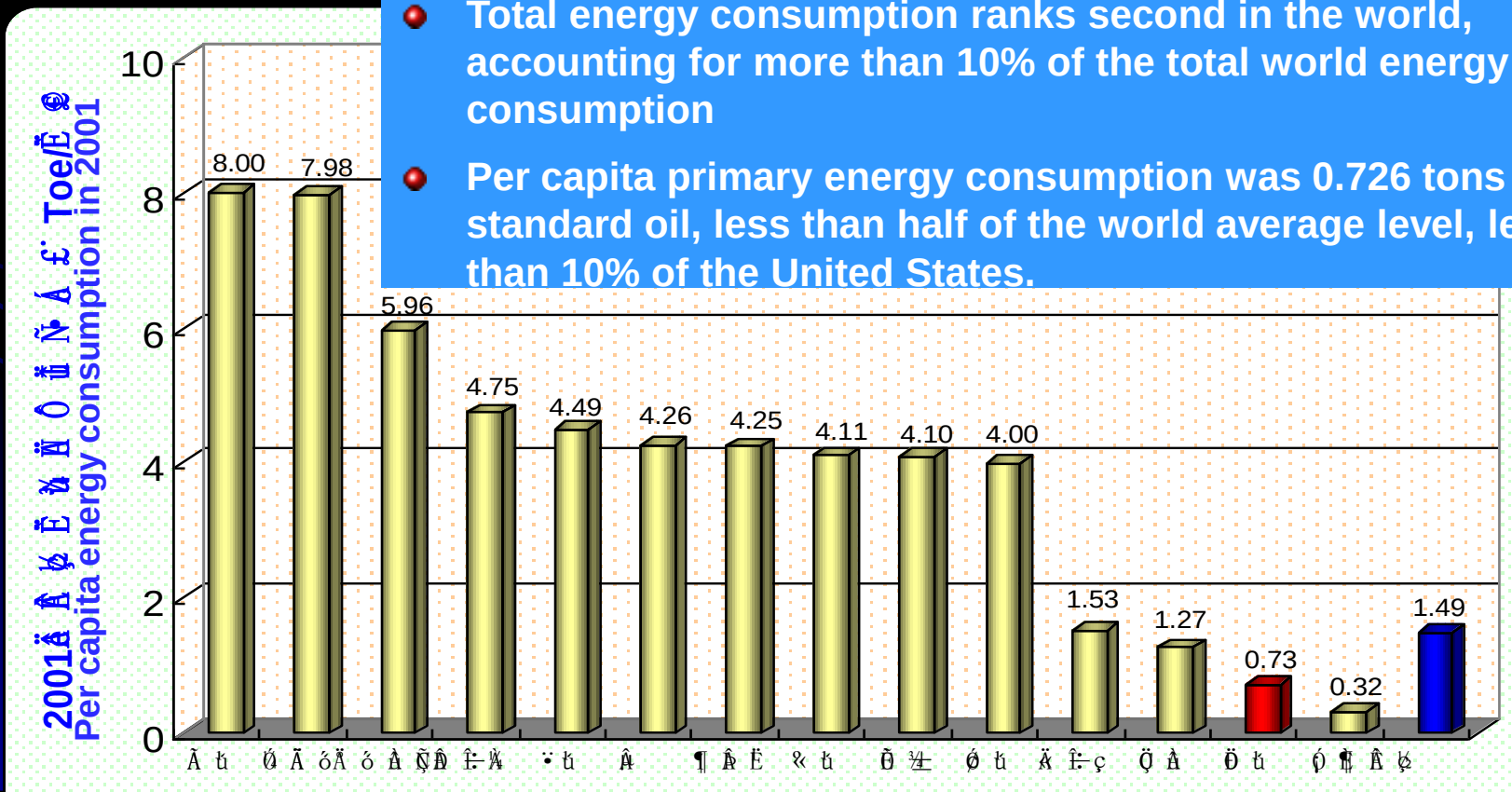
1. Energy problems and challenges in China

Total energy consumption is large, but per capita is little

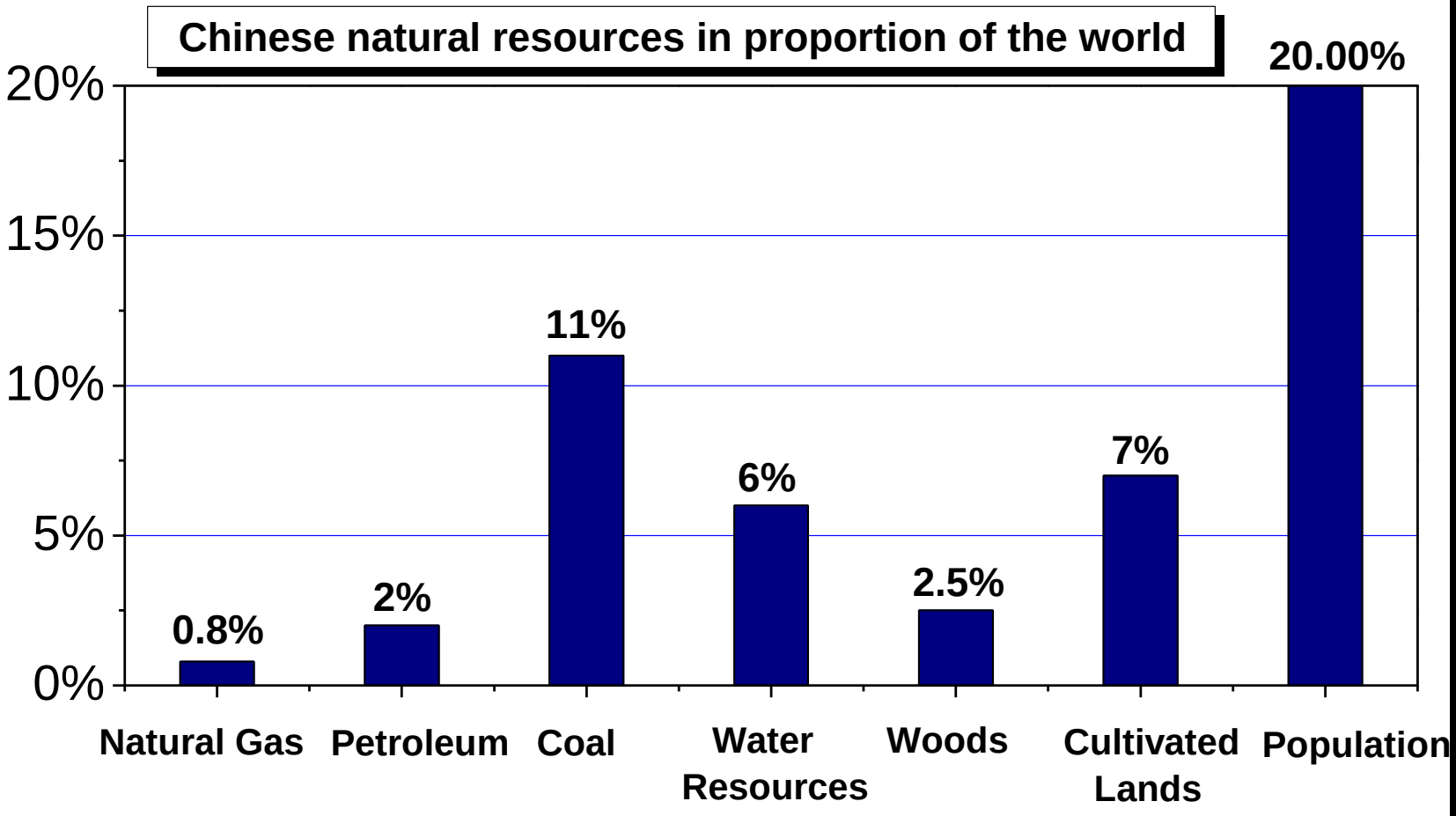
- **Total energy consumption ranks second in the world, accounting for more than 10% of the total world energy consumption**
- **Per capita primary energy consumption was 0.726 tons standard oil, less than half of the world average level, less than 10% of the United States.**



Installed Power Capacity in China

year		2000	2010	2020
Total installed capacity (GW)		327.4	587.7	930.0
Hydro	Installed capacity	79.30	150	220
	ratio	24%	25.5%	24%
Coal	Installed capacity	237	400	600
	ratio	73%	68%	63%
Gas	Installed capacity	7	20	50
	ratio	2%	3.4%	5%
Nuclear	Installed capacity	2.1	11.7	40
	ratio	0.6%	2%	4%
New energy (wind, solar, biomass, terrestrial heat, etc)	Installed capacity	2.4	6	21
	ratio	0.7%	1%	2%

China is short of natural resources compared to its population



CO_2 Emission in China

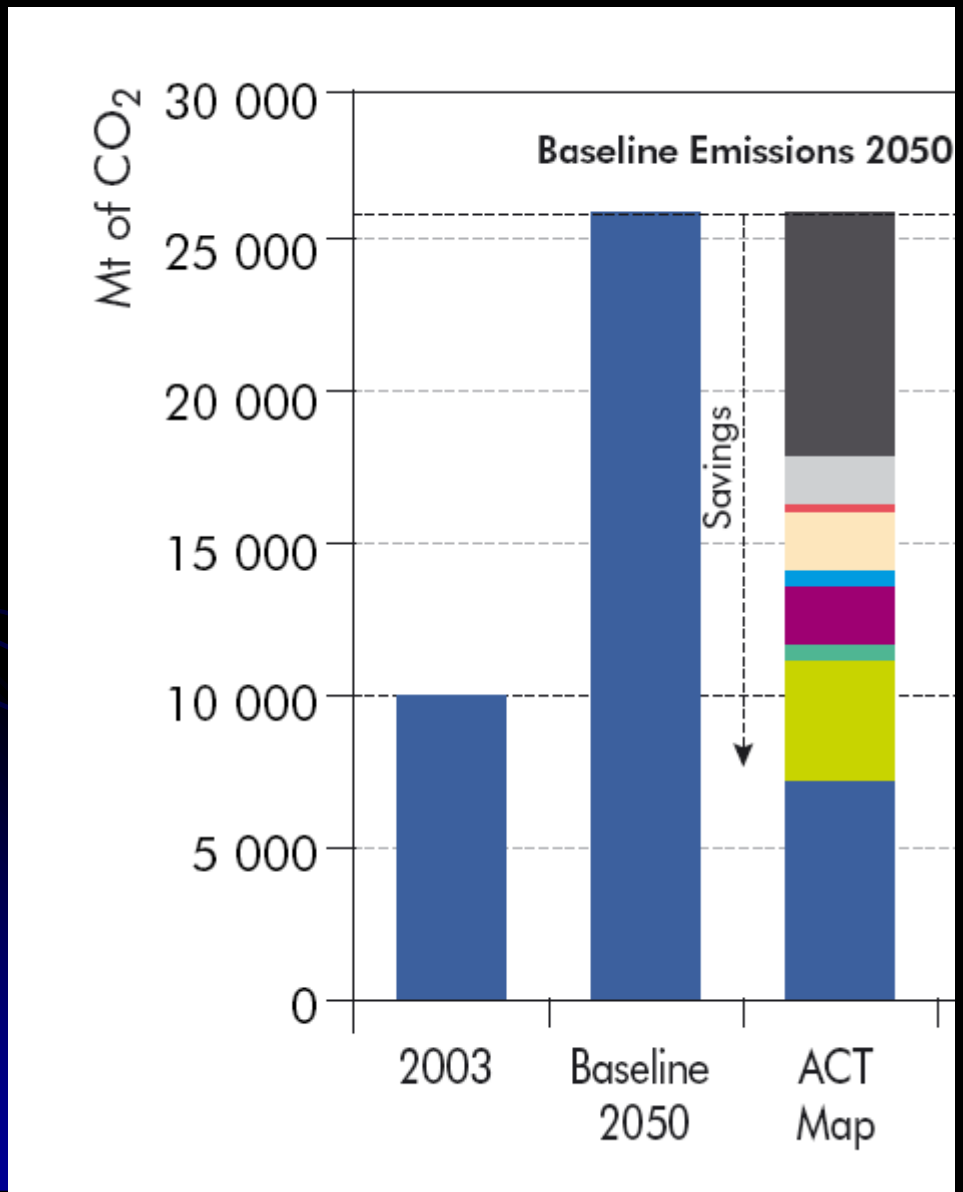
Year	Total	Coal		Petroleum		Natural Gas	
	Mt CO_2	Mtc	%	Mtc	%	Mtc	%
1990	2,241	1,886	84.2	325	14.5	30	1.34
2003	3,898	3,117	80.0	711	18.2	70	1.80
2004	4,707	3,809	80.9	816	17.3	83	1.76
2010	6,432	5,103	79.3	1,151	17.9	178	2.76
2015	7,376	5,946	80.6	1,184	16.1	246	3.33

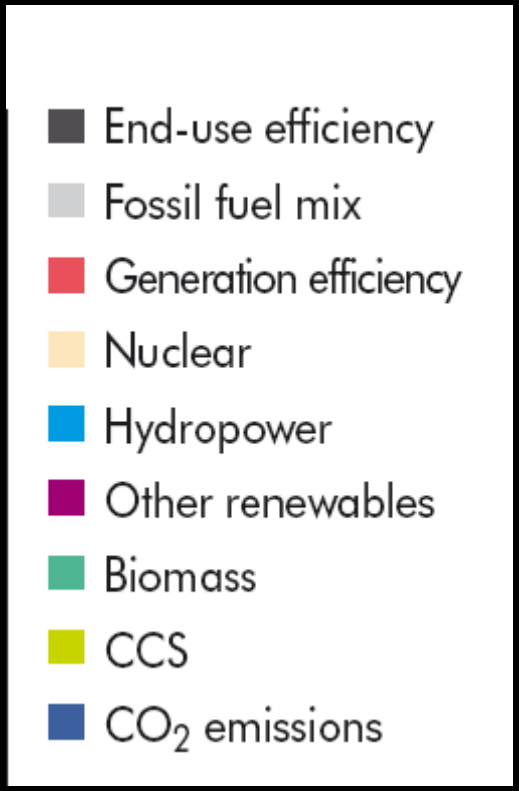
Source: Energy Information Administration/International Energy Outlook 2004 with High Oil Price Case.

2. Methods to reduce CO_2 emission

1. Energy saving
   saving coal 1 ton--- reducing CO2 emission 2 ton
2. Increase energy efficiency
3. Using renewable energy as much as possible
   Biomass: 2 ton — 1 ton standard coal
   MSW: 7 ton — 1 ton standard coal
4. CO_2 capture and storage
5. To reduce solar radiation to the earth

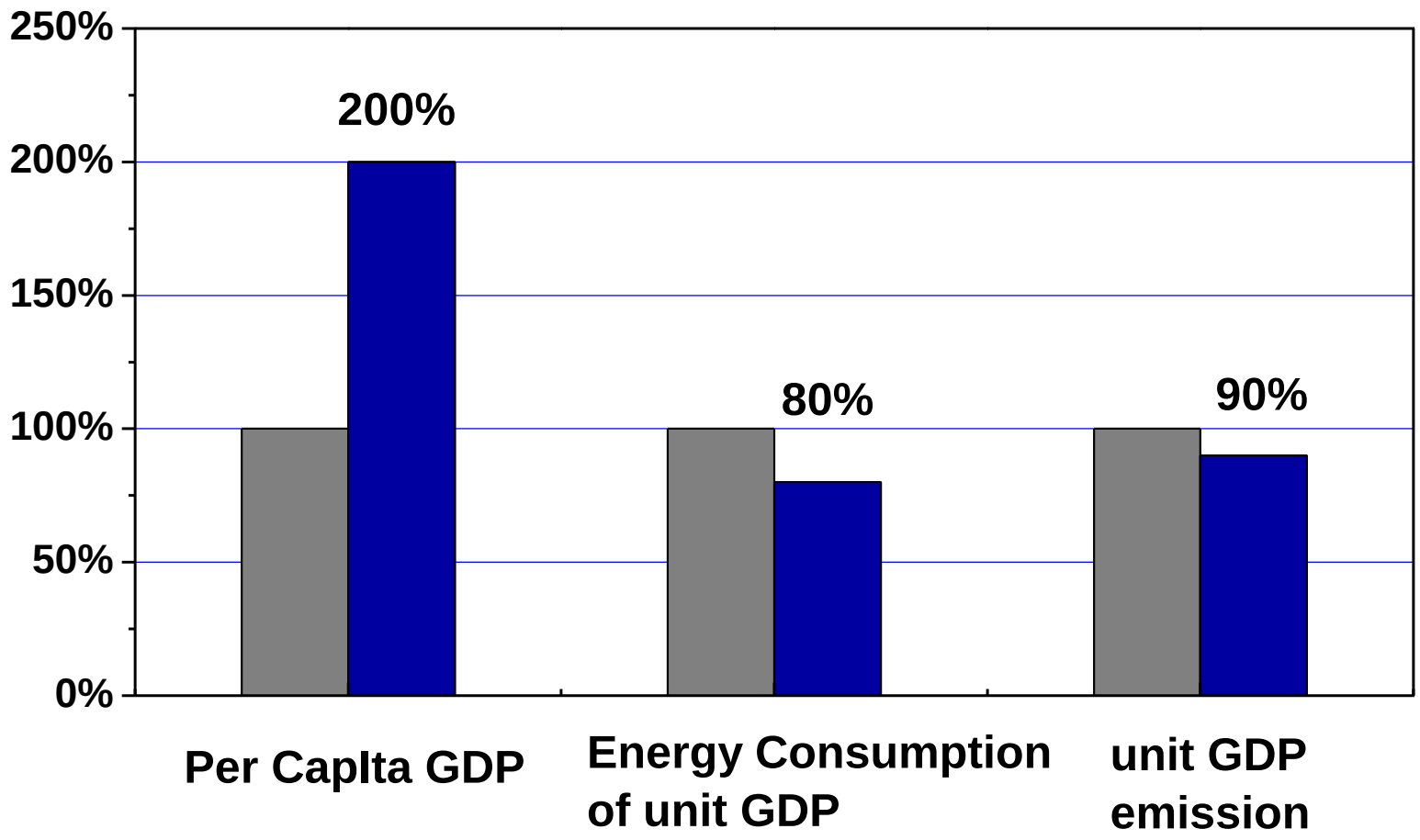
Potential Analysis on CO_2 Emission Control for IEA ACT Map Scenario by Energy Category





Increase Energy Efficiency is one of the important way to control CO2

National Goal in China
(To 2020)



3. Some methods to energy-saving in China

① Ultra supercritical power generation

② Industrial energy-saving

③ Poly-generation Technology

④ Renewable energy development

⑤ Municipal solid waste (MSW) for power generation technology

①Ultra supercritical power generation

Type of unit	Steam pressure (MPa)	Steam temperature (℃)	power generation efficiency （%）	Coal consumption （g/kWh）
Subcritical	17.0	540/540	38	324
Supercritical	25.5	567/567	41	300
Subcritical with high temp.	25.0	600/600	44	278
ultra supercritical unit	30.0	600/600/600	48	256
ultra supercritical with high temp.	30.0	700	57	215

- In general, thermal efficiency of supercritical unit is 2~2.5% higher than subcritical unit, ultra supercritical unit is 4~4.5% higher.

Huaneng Yuhuan ultra supercritical Power Plant

华能玉环超超临界发电厂

Huaneng Yuhuan ultra supercritical Power Plant
华能玉环超超临界发电厂

- **Total installed capacity: 4×1000MW, investment will be RMB 9.95 billion.**
- **Main steam temperature/pressure : 600 ℃/ 26.25MPa**
- **Reheat steam temperature/pressure : 600℃/ 5.557Mpa**
- **Boiler efficiency 93.65%, power generation efficiency 45.2%, Coal consumption 272g/kWh self-use electricity 4.5%(without de-Sox)**

Development of ultra supercritical unit

- Until Oct.2006,1000MW ultra supercritical unit has been planned to set up 18 units,600MW for 10 units;
- Statistically, during the coming 15 years, all the stalled capacities of supercritical and ultra supercritical units is 240GW.

Energy-saving potential for electric power

year	2002	2010	2020	Save (%)
Coal consumption / Kw·h (g standard coal/Kw·h)	383	360	330	13.8%
Self-use electricity (thermal power, %)	7.1%	7.0%	6.5%	8.4%
Line loss	7.45%	6.5%	6.0%	19.5%

To 2020 , save 96.8 million tons standard coal comparing to 2010.

② Industrial energy-saving

A、electromotor

series	China Y	China Y2	China Y2E	Germany Simens	Germany ABB	EU eff1	EU eff2	USA EPACT	USA NEMA
η%	87.3	86.3	87.9	86.5	87.1	89.1	86.4	90.3	91.7

（1）if reach the level of USA, Motor efficiency can be increased by 4 ~ 6% .

（2） Adjustment and transformation for electromotor.

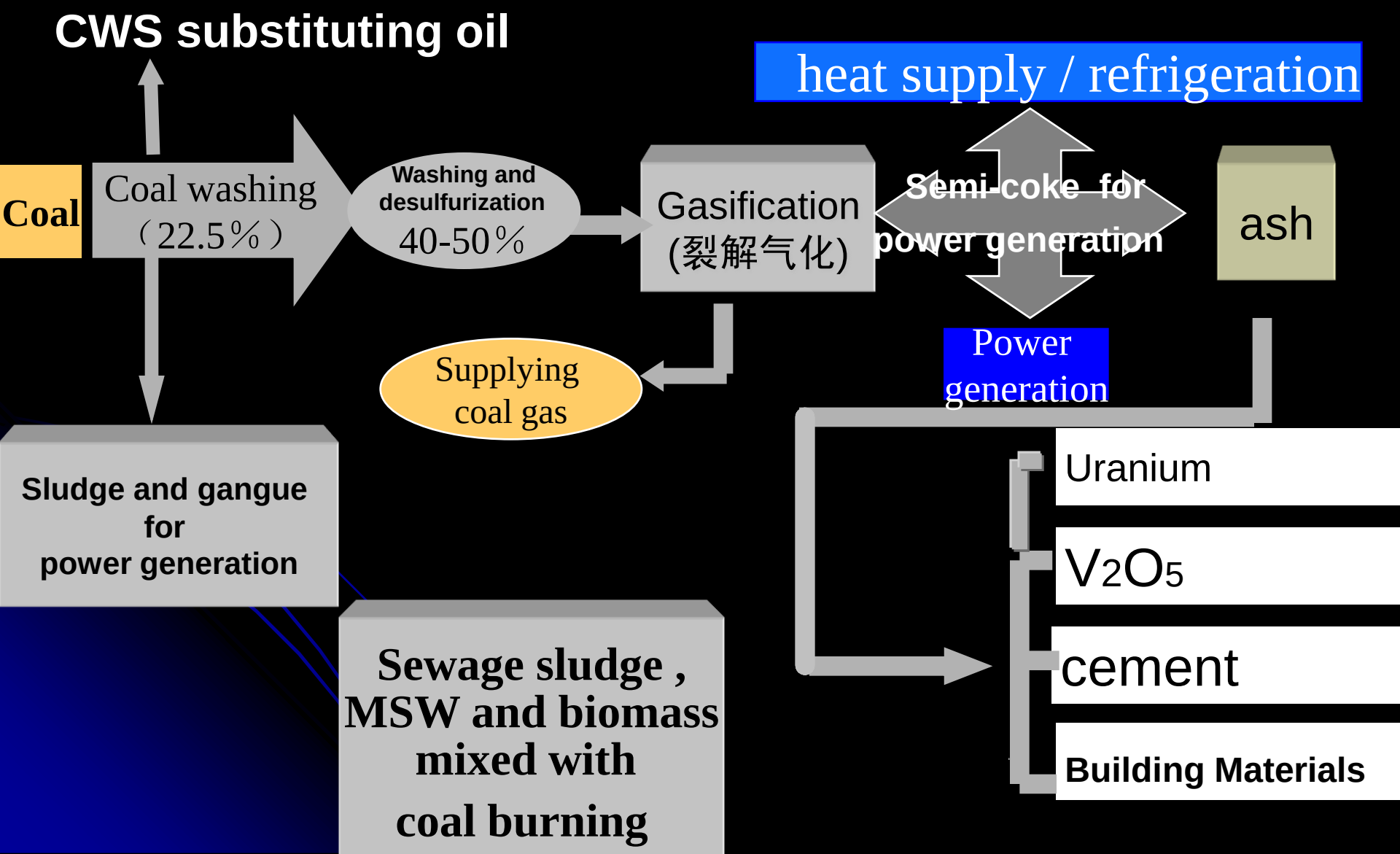
B、pump

-China's average pump efficiency is 2～5% lower than advanced .

C、fans

- The overall level of fan in china is equal to the international level in 1970s.

③Coal poly-generation program for CO2 reduction



Case 1:

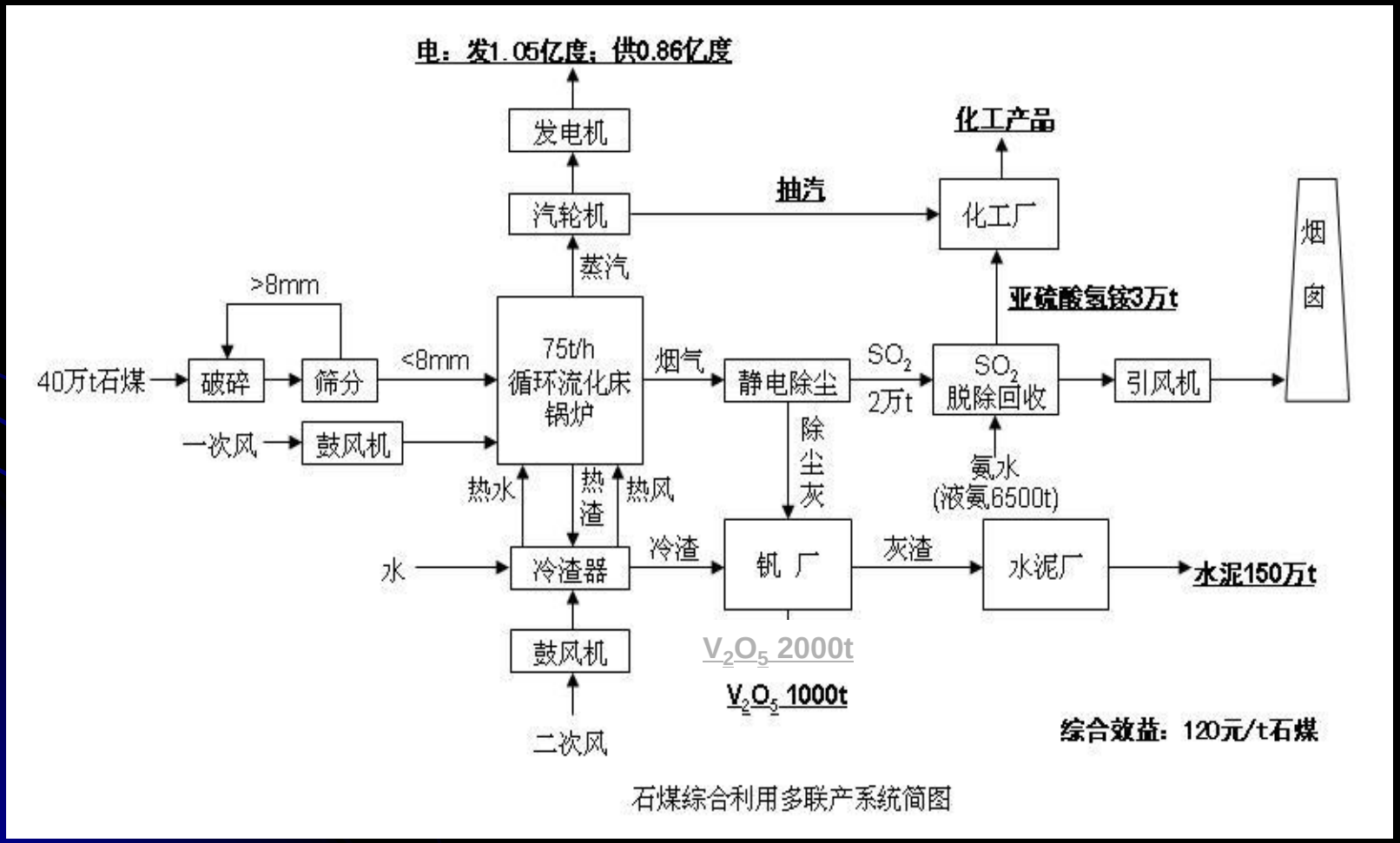
power generation, vanadium pentoxide (V_2O_5) extraction and cement poly-generation technology

Reserves of stone coal in China is 61.9 billion ton and vanadium is 170 million ton

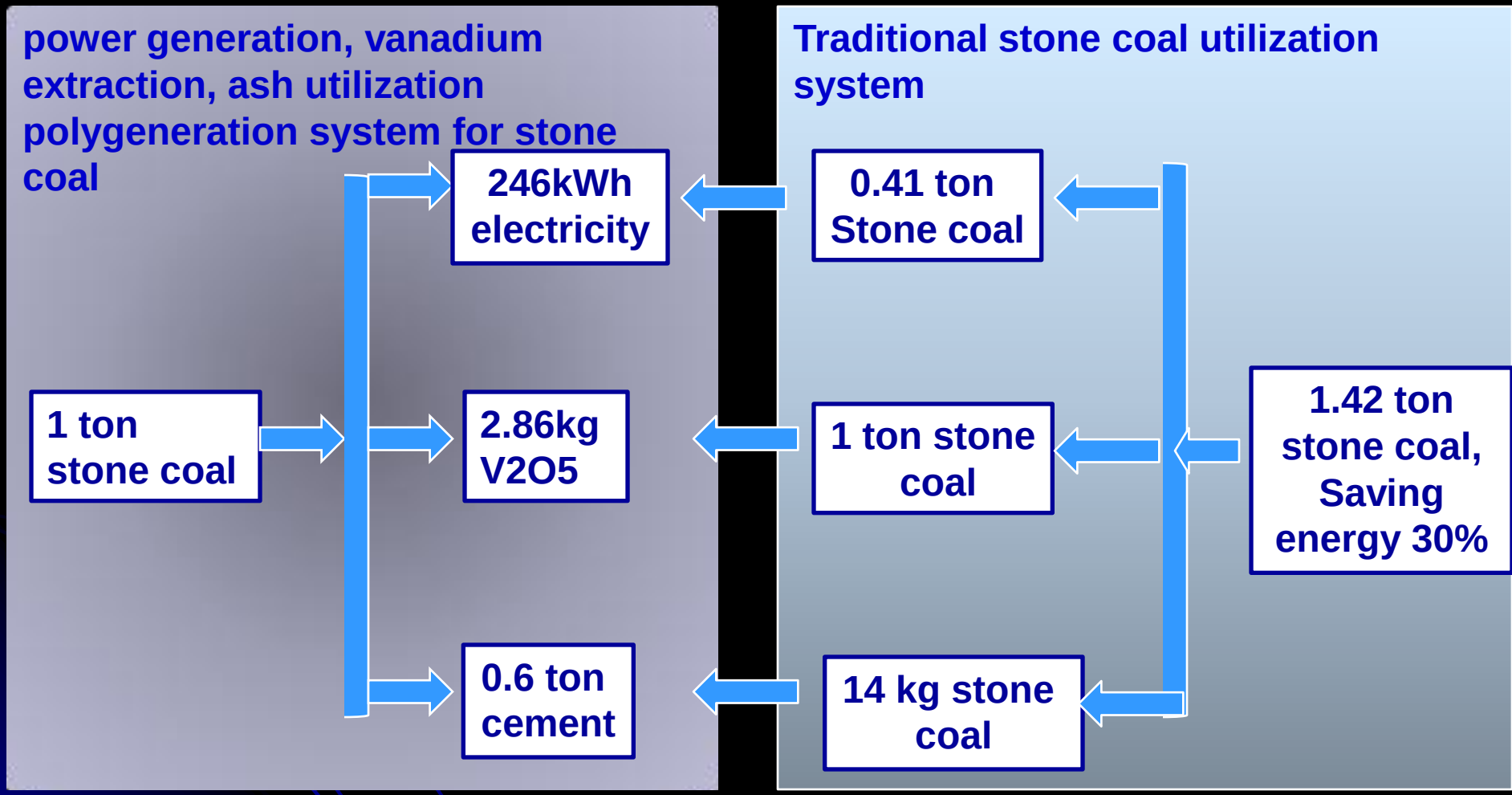
全国石煤储量619亿吨，含钒1.7亿吨。

province	Hunan	Hubei	Guangxi	Jiangxi	Zhejiang	Anhui	Shanxi	Total
Stone coal /billion tons	18.7	2.6	12.9	6.8	10.6	7.5	1.5	61.9
V_2O_5/ million tons	40.46	6.05	50	24	22.78	18.95	5.62	167.97

2×15MW power generation, vanadium (V_2O_5) extraction, ash utilization poly-generation system for stone coal in Shanglin Guangxi



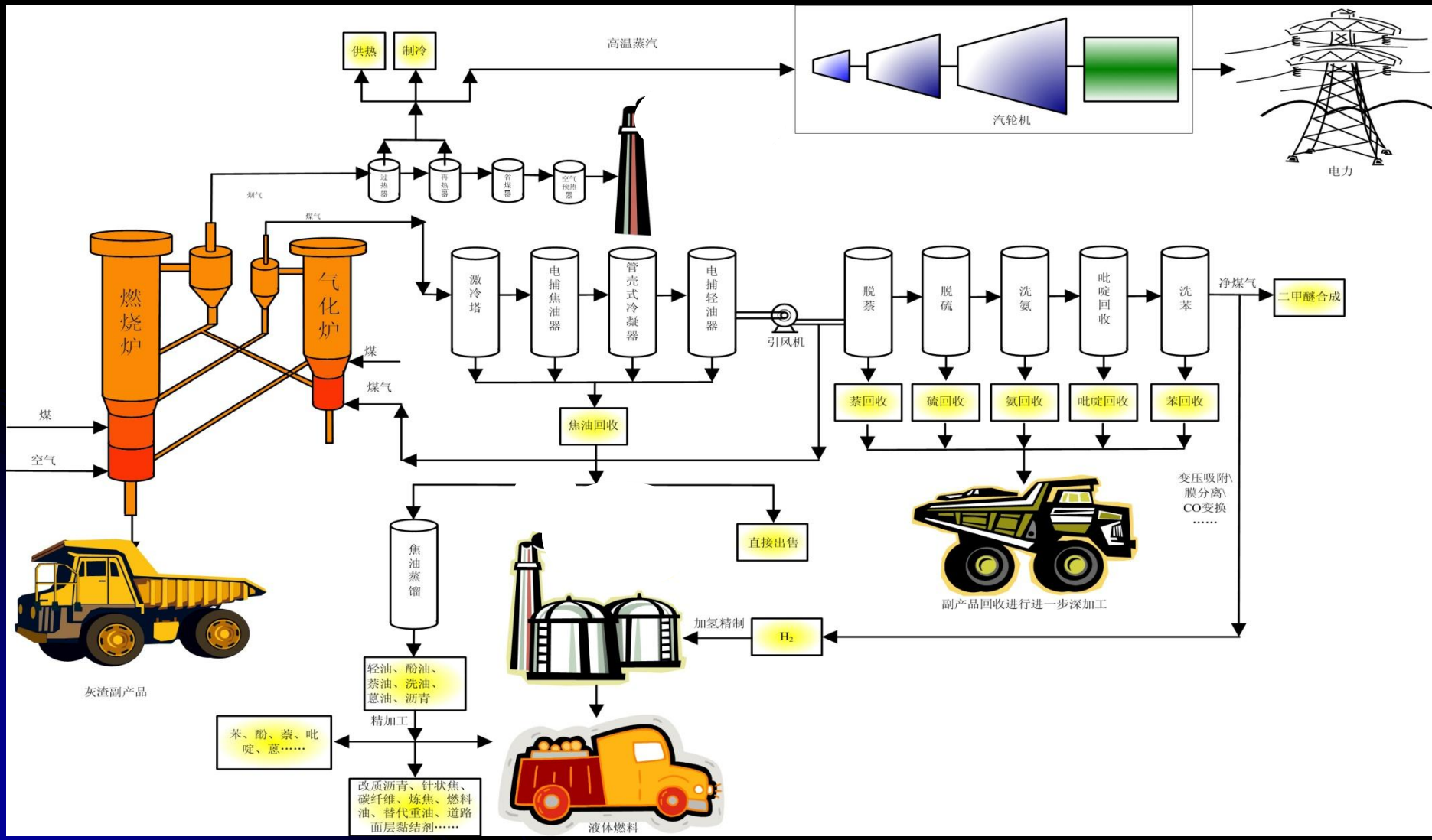
CO_2 emission reduction by poly-generation system



Saving stone coal 420 kg per ton stone coal

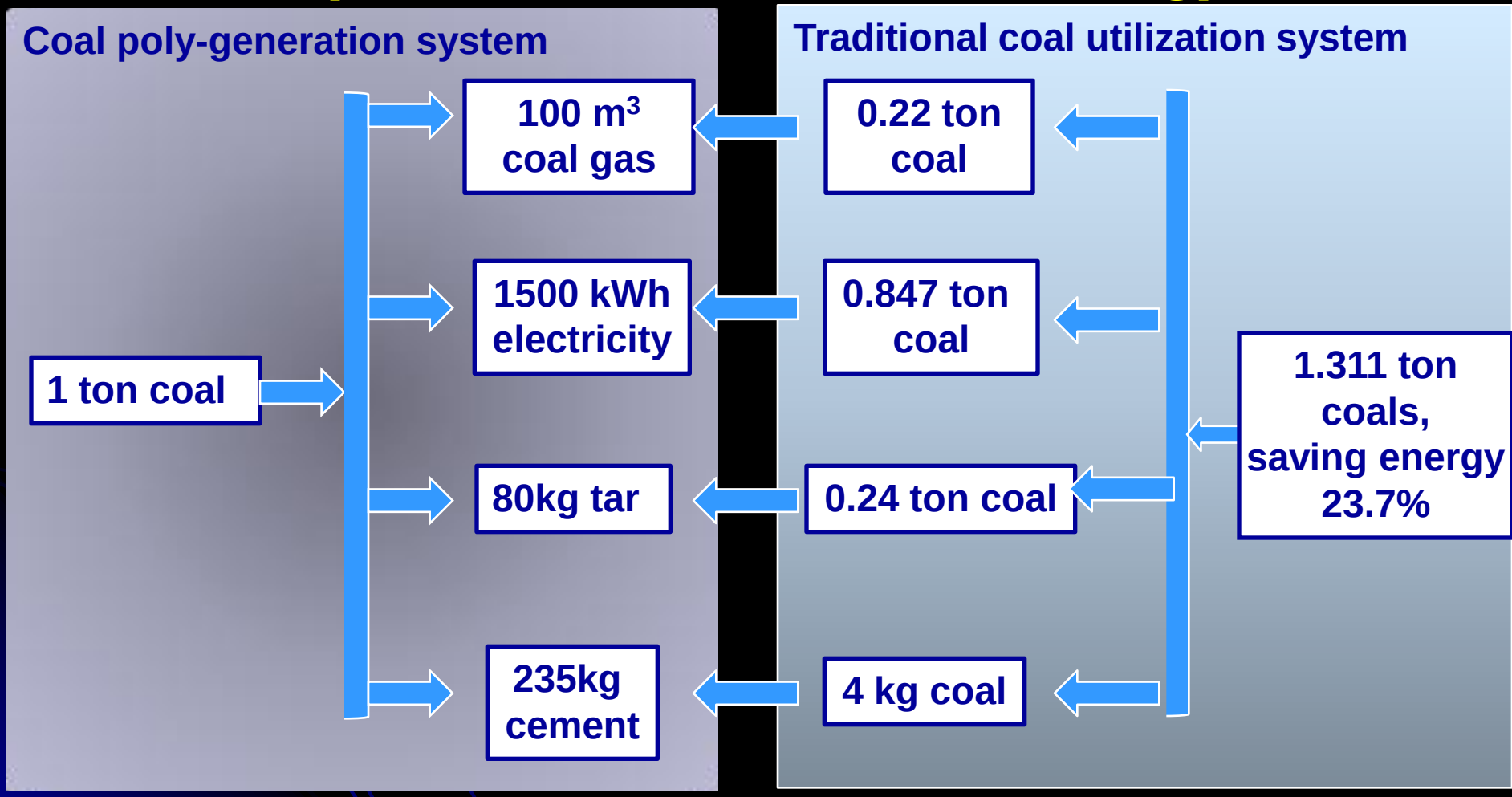
Reducing CO2 emissions 120 kg per ton stone coal

Case 2： Poly-generation using coal for electricity, heat, tar, gasification



12MW CFB poly-generation project for heat, electricity, gas and tar

CO_2 emission reduction by coal poly-generation system (Bituminous coal, 20MJ/kg)



Saving coal 311 kg ton coal

Reducing CO2 emissions 622 kg per ton coal

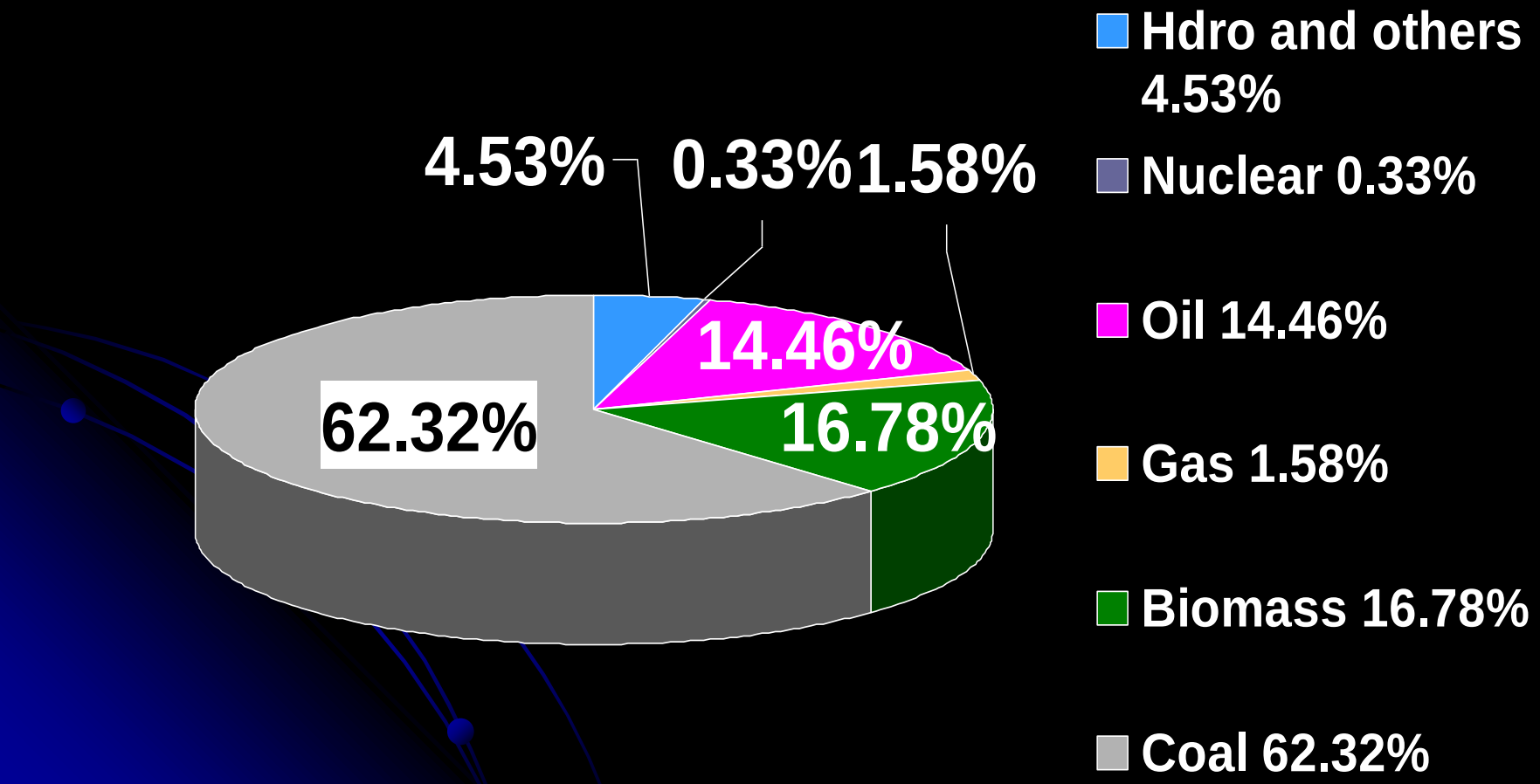
④ Renewable energy development
《可再生能源发展“十一五”规划》解读

- Object: Until 2010, renewable energy consumption of total is over 10%; annual utilization amount is 0.3 billion ton standard coal;
- 总目标：2010年，可再生能源在能源消费中的比重达到10％，年利用量达到3亿吨标准煤.

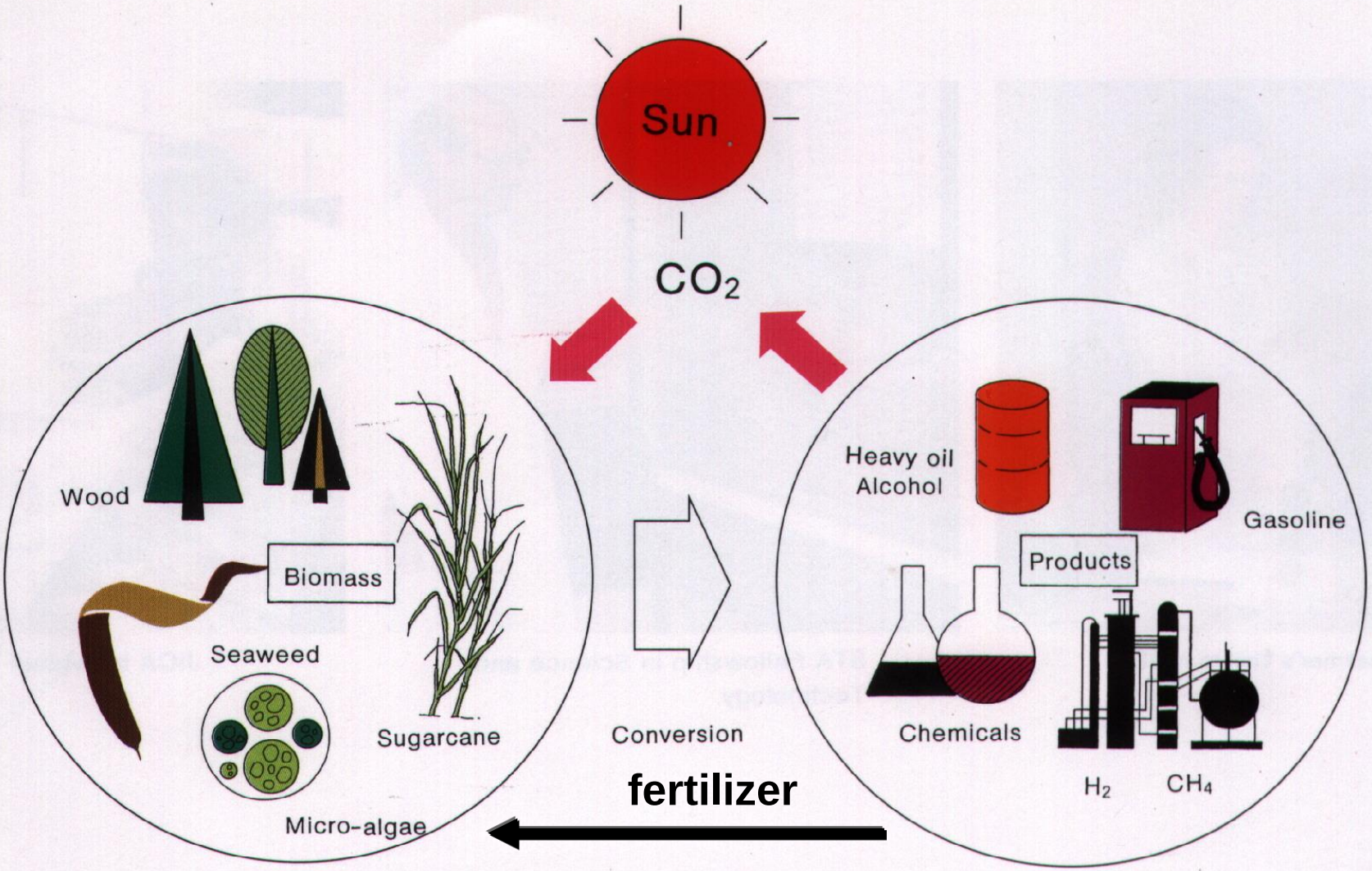
Power capacity	2010	2020
Hydro power	190GW 73GW increase during 2006-2010	300GW
Biomass power	5.5 GW 10% of total capacity	20GW 5% of total capacity
Solar energy	0.3GW	1 GW
Wind power	10GW 9 GW increases during 2006-2010	20 GW

Development program of renewable energy resources in China
中国可再生能源发展规划

China Primary Energy Consumption



CO_2 Circulation through Biomass Utilization



CO_2 Circulation through Biomass Utilization

100% STRAW FUELED CFB BOILER —— 2×12MW$_e$ CHP in Jiangsu

Suqian Straw Power Plant

straw on truck

Indoor yard

Corner of outdoor yard

straw conveyer

Boiler and loopseal

CO_2 emission reduction using biomass power generation

Biomass raw material

1 ton

→ **1000kWh** ←

Standard coal 370 kg (29MJ/kg)

Saving Standard coal : 370 kg coal/t biomass

Reducing CO2 emissions : 740 kg CO2/t biomass

12MW Biomass Power Plant using 100000t biomass per year,

Reducing CO2 emission: 74000t per year

⑤ Reuse (废物再利用)

discard as useless 报废品	2010	2020
Automobile	2.5 million	6 million
computer	10 million	20 million
TV set	9 million	15 million
Air-condition	12 million	50 million
Refrigerator	9.6 million	20 million
Recycling ratio	95%	100%
Remanufacture ratio	50%	80%
Ratio of resource	80%	95%

⑤ Reuse (废物再利用)

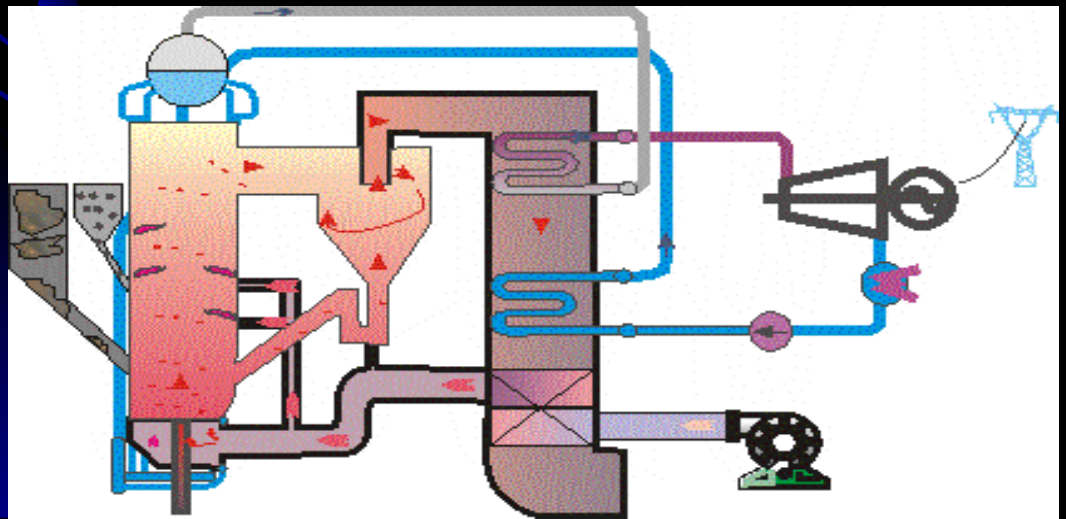
Inclusion of computer wasted main-board per ton 1 吨电脑板中含(kg)								
Item	Gold 黄金	Cu 铜	Sn 锡	Ni 镍	Pb 铅	Sb 锑	Plastic	Pt.Pd 铂，钯
Content 含量	0.5	128	39.6	36	58.5	19.8	270	A little

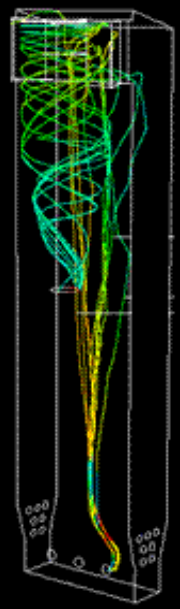
⑥Municipal solid waste (MSW) for power generation technology

- In 2004, more than 660 cities produced 155 million ton municipal solid waste, the accumulated packing quantity is more than 7 billion ton.
- In 2004, the harmless treatment rate of the city domestic waste is only 52%, that of country is even slower.

The innovation of CFB domestic waste incineration technology

- High specific gravity inertia material circulation
- Special distributing wind combined with directional air cap
- Second air vortex sectionalized combustion
- Waste leachate reject into furnace combustion





Hangzhou Jinjiang MSW Incineration Power Plant

The waste treatment capacity is 800 t/day (1×200 t/day + 2×300 t/day).
The electricity generation is 18MW.

CO_2 emission reduction by MSW incineration

Municipal solid waste

1 ton

burning

300kWh

Standard coal
93 kg (29MJ/kg)

Saving Standard coal : 93 kg coal /t waste

Reducing CO2 emission : 186 kg CO2 /t waste

18MW MSW Incinerator using 800 t/d

Reducing CO2 emission: 44,640 t per year

The waste incineration power plant that are put into operation by Zhejiang University

1. 11 MSW power plants under operation, the waste treatment amount reach up to 7550 tons/day
- - 11 MSW power plants for 9100t/d MSW treatment under
- construction.
- - The CO2 emission reduction of 22 units : 1 million ton per year

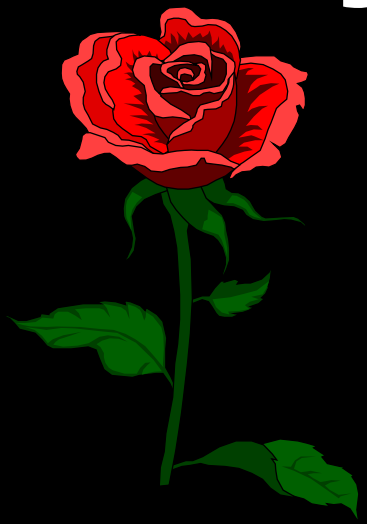
The waste incineration power plant	Garbage handling capacity	Operation Date
1. Yuhang jinjiang environmental protection energy limited company	150t/d	08/98
2. Heze jinjiang environmental protection energy limited company	400t/d	04/01
3.Hangzhou jinjiang green energy limited company	800t/d	06/02
4.Zhengzhou Yingjin environmental protection energy limited company	1050t/d	10/02
5. Wuhu oasis environmental protection energy limited company	600t/d	01/03
6. Yiwu shuangfeng environmental protection heat power limited company	1200t/d	04/03
7. Jiaxing green energy limited company	250t/d	11/04
8. guangdong dongguan kewei environmental protection electric limited company	1600t/d	06/05
9. fujian shishi waste incineration comprehensive treat plant	300t/d	01/06
10. zhejiang bada jinhua heat power limited company	400t/d	02/06

Conclusion

High efficient energy-saving methods:

- **Improve the energy utilization efficiency, e.g. ultra supercritical unit;**
- **Innovation of technology system, e.g. poly-generation system;**
- **Renewable energy utilization, e.g. biomass, biogas, solar energy, etc.**

Thank you !



③ Developing Poly-generation Technology —— energy saving and CO_2 emission reduction in China